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ORTHOGENETIC SERIES INVOLVING A DIVERSITY OF MORPHOLOGICAL SYSTEMS.*

STUDIES IN DETERMINATE EVOLUTION. II.

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In the first paper† of the present series dealing with the evolution of plants, a general survey was given of the fundamental, progressive movements which have taken place in the entire kingdom. The present study deals with several examples of morphological structures which require the evolution of a complex reaction system to bring about the harmonious development of all the parts. These special cases have been selected not because they are exceptional but because they represent rather bizarre examples, illustrating a condition which confronts us on every side—a progressive movement resulting in the development of a more and more perfect system until the ultimate limit is attained, which in some cases gives a condition of over-adaptation, in others a structure very useful, apparently, to the individual, in others a very "useful device" which is however of no utility whatever to the individual in the matter of survival, and in still others a structure which has no special use at all. Each of the three examples given begins in a very slight movement and ends in a remarkedly perfected consummation, which was of no importance in the first place and which could give no hint as to the remarkable end to which future steps would lead. As stated, such cases are present in great abundance all through the plant kingdom.

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†Schaffner, John H. The General Course of Evolution in the Plant Kingdom.

THE EVOLUTION OF A HIGHLY DEVELOPED BUR IN THE PANIC-GRASS TRIBE.

(See Plate I.).

Grasses in general do not have any special bristles developed at the base of the spikelet. The structures are usually naked or merely pubescent with epidermal hairs. In the genus Chaetochloa and related groups a new structure appears which in its simplest expression is represented by the presence of one or two stiff cortical outgrowths or bristles at the base of the pair of spikelets. *Chaetochloa verticillata* (L.) Scribn. is a typical example (Fig. 1). In this species the bristles are retrorsely barbed, as frequently occurs in structures of this type whether they represent modified spines, prickles, sepals, petals, or other organs. Formerly the possession of such a peculiar structure, especially if some apparent use could be found for it, was a plain case of use or disuse or natural selection. In the case in hand, however, the grains enclosed in the flowering glumes fall away when ripe and the bristles with their retrorse hooks remain behind on the dying plant. Had the bristles been attached to the abscissed fruit, it would have been a plain case of utililarian teleology to the credulous scientists of a generation ago. The important addition to the hereditary potentialities is something that is influencing the cortex to develop outgrowths when the ontogenetic gradient has reached the base of the pair of spikelets. The subsequent examples in this series will show how this peculiar character is increased step by step through a number of genera and many species.

Figure 2 represents *Chaetochloa imberbis* (Poir.) Scribn. which has 10 bristles at the base of the spikelets. These bristles are upwardly barbed, just the opposite from those of *C. verticillata*, and also remain behind on the old dead inflorescence when the spikelets are shed. If they were persistent on the abscissed spikelets, probably some one, still deluded by Lamarckian or Darwinian teleology, would claim that they were turned thus in order to prevent the bristles from clinging to passing beasts and men because they might thus be carried away too far and perhaps to an unfavorable habitat; since it is plain that they are in a favorable habitat already, otherwise the parent plant would not have survived to produce a crop of seed. Other species have bristles ranging between 2 and 10 and some have more.

In *Pennisetum glaucum* R. Br. there is not only an involucre of numerous stiff bristles and hairs around the base of the pair of spikelets (Fig. 3) but the cortical part of the stem bearing them is somewhat expanded. This represents a decided step in advance over the condition represented by *Chaetochloa imberbis*.

Figure 4 represents a low type of sandbur-grass, *Cenchrus myosuroides* H. B. K., which has a moderate development of prickles and a much more prominent cortical expansion round the spikelets. In figure 5, which represents the bur of our common sandbur-grass, *Cenchrus pauciflorus* Benth., the development of the basal cortical expansion is shown to have advanced decidedly and the prickles have become strong and rigid. The spines are retrorsely barbed and aid decidedly in helping the bur to hold on to one's toes or fingers and thus in being carried away from the favorable habitat of the parent plant to some possible, sterile ground where a cruel death may await the little sprouting embryos asleep within. Now, this bur is a very perfect device.

But there is still room for improvement, and the ideal is reached in such species as *Cenchrus palmeri* Vas. (Fig. 6) which has a very large prominently developed bur with large, long, stout prickles enclosing the spikelets with their ripe grain. Thus all these species and many others show a consistent orthogenetic movement from the very slight disturbance in the basal cortical development of *Chaetochloa verticillata* to *Cenchrus palmeri*. So far as the ability to get along in the world and to perpetuate itself are concerned, the last species is no better off than the first even though we have evolved a very ingenious structure to hold the seed as it comes from the parent plant. The first three important steps have no such use. So unless they were working for the good of the more highly perfected species of Cenchrus still to be evolved, it would be absurd to say that their first necessary steps were of any utility to themselves whatever. And there is also no evidence whatever that the elaborate bur is of any advantage to its possessor so far as a life and death struggle is concerned. For sandbur-grasses and foxtail-grasses grow side by side in the same field and the foxtails seem to be succeeding as well if not better than their neighbors with the perfect seed-holding device.

AN ORTHOGENETIC SERIES LEADING TO AN "ALABASTER BOX."

(See Plate II).

The Andropogoneæ, or beard-grasses, are even more extremely evolved than the panic-grasses just considered. It is, therefore, not surprising to find very remarkable peculiarities among them. The series which is outlined below represents the development of a box to hold the pair of spikelets and finally the mature grain. It is, in a broad sense, a device similar to the preceding case. But the box is produced by entirely different elements on a fundamentally different plan.

Many of the lower Andropogoneæ have quite ordinary panicles. The spikelets are in pairs, one stalked and one sessile. The specialization of these pairs of spikelets and their flowers presents a very interesting case of orthogenetic movement in itself in the various species series which will, however, not be considered here. In some of the less specialized genera, there is no special development of joints or abscission layers in the rachis below the pair of spikelets.

Passing from such species with continuous inflorescence branches, like *Miscanthus sinensis* Anderss., we come to forms represented by *Andropogon furcatus* Muhl. (Fig. 1) in which the branches of the inflorescence are very definitely jointed, and at maturity they are cut up into definite pieces by the formation of an abscission layer just below the insertion of the pair of sessile, grain bearing, and stalked, staminate spikelets. The rachis joint is slightly flattened on the side on which the spikelets are situated. Thus the first steps have been taken in the production of a typical crate for the grain in some future time and which may develop in some fortunate individuals which have advanced farther up the evolutionary ladder. The most important potentiality present is the ability to cut the material into suitable pieces at the proper places.

Figure 2 represents the rachis joint and spikelets of *Hemarthria fasciculata* (Law.) Kunth. The structure begins to have the first crude characteristics of a box. The rachis joint is flattened and somewhat excavated. The pedicel of the stalked spikelet is involved in this reaction and is usually grown to the edge of the rachis joint. The outer empty glume forms a respectable loose-fitting lid which is, however, too long for the box. The stalked spikelet is still entirely outside of the structure. In addition, another crude reaction which represents

a first step is evident in the articulation since the joints in Hemarthria are only tardily disarticulating. It is very commonly the case that both in important phylogenetic progressions as well as in trivial characters, the first steps are often imperfect, indefinite, or undependable. Just a little disturbance of the physiological states may cause either complete failure of the new hereditary expression or an imperfect expression. To find the promptness and decidedness of the abscission reaction, in contrast, one has only to go to the end of the series and examine a carpellate inflorescence of teosinte (Euchlaena).

Figure 3 represents a typical species of Coelorachis, *C. cylindrica* (Mx.) Nash. Here we have a box looking like the work of an amateur. The rachis is enlarged and deeply channeled; the abscission is definite; the stalked spikelet is greatly reduced and its flattened pedicel assists the lid in enclosing the fertile spikelet. The outer empty glume of the fertile spikelet is thickened and ornamented to some extent and forms an ill-fitting lid. The parts of the box fit better than the figure would indicate, since the "lid" and other glumes have been separated, for drawing, to show their nature more clearly. Other species of Coelorachis show the evolution of the box a little more perfected.

The gama-grass presents us with a well-evolved structure as shown in Fig. 4, *Tripsacum dactyloides* L. The rachis joints are enlarged and channeled out into deep troughs; the abscission is prompt and definite and the outer empty glume forms a well-fitting lid to close the opening; the carpellate spikelet with the mature gain is neatly boxed up. Were this structure about 10 times as long as it actually is, we could write an address on the side and, with the proper postage stamp, have it delivered through the mails to some distant office, confident in the fact that the parcel had been properly packed. Now the boxing up ability or potentiality has been properly attained by the adjustment and coordination of a large number of organs all of which had to evolve in the proper direction if the end result was to be attained. The box could be improved and beautified in various ways, however, and here we will find a principle at work that is of wide application in the entire realm of plant evolution. Evolution is above all perfective, and so cases are abundant where certain species have passed to this perfected ideal, often far beyond the limits of any real or imaginary

utility. There is no use of mincing words. These examples given are only selected cases out of great numbers of similar developments that any one can discover for himself if he is willing to spend 25 years of correct and intensive study in the taxonomy of plants.

The perfected box is attained in *Euchlaena mexicana* Schrad., or the teosinte, which stands at the limit of the Tripsacanæ subtribe in many other respects. Figure 5 is a drawing of the mature boxed-up carpellate spikelet of this grass. This is a true "alabaster box." Both the modified stem and the modified outer empty glume, which represent the box and its lid, are highly indurated into a hard, crustaceous polished substance and there are also ornamental blotches or mottelings in evidence while in Tripsacum no such ornamentation is in evidence. The whole box has been rounded off so that the crude rough edges, so prominent in Tripsacum, have been removed; the abscission surfaces, not visible in the drawing, have been contracted into comparatively small areas; the lid fits perfectly, and, *mirabile dictu*, is clamped down by the inrolling of the edges of the box. The point of perfection of workmanship has been attained. The spikelet with its grain is perfectly encased. Determinate evolution has about reached its limit. There is one further possibility. The surface, instead of being smooth, might be ornamented as often occurs in highly evolved, indurated structures. This actually did take place in some related genera which however, did not get quite as far in general as teosinte. As stated, ornamental markings are abundantly to be found in indurated seeds, fruits and other hard structures. In the higher plants, ornamentation is commonly an accompaniment of the evolutionary movement of induration. Now compare Fig. 1. with Fig. 5. and you have a picture of the real process of evolution. All the related species of the series can be arranged in an orthogenetic order, the various species having positions at various levels of advancement.

Teosinte grows side by side with Andropogons which have no alabaster boxes for their grains. So far as survival is concerned, one is as well off as the other. The box is of no use to its possessor in a life and death struggle for existence any more than a gold watch keeping very accurate time is of importance for the survival of a savage. Nevertheless it is an ingenious, pretty box useful for holding the grain. In dis-

covering the facts of orthogenetic series we are not concerned about the relation of one step to another, nor about the order of the appearance of the steps. These are propositions that can never have any direct proof except such as may be gleaned from the imperfect paleontological record. Our chief concern is in the validity of the series in closely related groups of species and when we have discovered this we know that although we may have difficulty in tracing the origin of these processes to their ultimate internal causes, we can rest on the convincing reality of the phenomena without being led into a belief of childishly superficial hypotheses as postulated in Lamarakism, in Darwinism, and in some of the more recently developed beliefs and fancies that would make of evolution a fortuitous process.

AN ORTHOGENETIC SERIES REPRESENTING THE EVOLUTION OF A POLLEN BRUSH.

(See Plate III. All the figures magnified on the same scale).

The relation of insects to pollination is quite generally known even among the non-scientific. In the dark ages of the last century, scientists and others firmly believed that the special adaptations to insects were evolved by natural selection through the survival of the fittest. The plant was under the necessity of being pollinated if a following generation was to inhabit the earth and it was assumed that there was some profound advantage in cross-pollination while selfing was supposed to be injurious enough to cause elimination in the long run. The implications seemed perfectly evident to the credulity of the supposedly critical biologists of the period. Now when we find that large numbers of species both in the wind pollinated and insect pollinated series, and especially many with elaborate mechanisms which seem especially devised to lure insects, are either cleistogamous or completely parthenogenetic, the whole hypothesis of the evolution of such structures being caused by the necessity of cross-pollination passes over into the realm of fairy tales. The lower undifferentiated species of flowers nearly always succeed in being pollinated while many which have extreme adaptations do so with difficulty. If one takes an inventory of an undifferentiated flower type like a crowfoot or an anemony he finds that ordinarily it is difficult to find a flower that is not pollinated, while some

extremely specialized flower like the common milkweed has about one chance in eighty. The higher forms usually develop zygomorphy and this with other movements reduces the supply of stamens and pollen per flower. But the same movement of reduction occurs in wind-pollinated series. The orthogenetic series here considered cannot be questioned. But when we ask for causal relations we find that at every step in the evolutionary process one type of individual is just as successful as the other. They all have survival value. The one without even a hint of the adaptation gets along just as well as the one which has developed it, to the extreme degree. The relation between the actual evolutionary process in the plant and the insects is no more evident than the relation of the flea to the dog on which it lives happily. Yet just as the flea could not exist without the dog environment so none of these plants of the given series could exist without the insects. The series presented is taken from the mint family. Essentially similar series, differing in details of structural development but not at all in the efficiency of the devices appear in many orders and families of flowering plants.

Figure 1 represents an ordinary type of stamen with no special peculiarities. It is a stamen of *Agastache scrophulariaefolia* (Willd.) Ktz. All the remaining 11 figures of plate III. show steps in the evolution of the structure under consideration. Since the drawings are all on the same scale, the evolution of both size and structure will be apparent as a progression toward perfection.

Figure 2 represents a stamen of *Teucrium occidentale* Gr. In this stamen something is at work which separates the two parts of the anther. Now, of course, no one in his rational senses would see in this minute device any advantage over the preceding in securing pollination, especially no survival value in a life and death struggle. But here we do have a new phylogenetic potentiality introduced with a very slight reaction. We could not predict whither it would lead unless we actually saw the series evolved through the operation of its orthogenetic property.

In figure 3, *Clinopodium vulgare* L., a considerable advance is shown in the enlargement of the connective between the two anther-sacs and in *Satureia hortensis* L. (Fig. 4) the anther-sacs are still farther apart. In *Monarda didyma* L. (Fig. 5) the connective has enlarged decidedly and in such a way that the

anther-sacs are completely divaricate. In the meantime it is evolving to a decidedly zygomorphic condition so that there are only two fertile stamens left. A further advance in the zygomorphic nature of the flower bud will involve the one anther-sac of each stamen. The peculiar potentiality which is separating the two anther-sacs to a greater or less extent in various genera and species in this region of the mint family has no direct relation to the development of zygomorphy itself but is an independent mutative manifestation. To claim that these slight changes in the contiguity of the anther-sacs and the enlargement of the connective had produced an advantage of any sort to the possessor would be the height of absurdity requiring the same kind of credulity as is necessary for a belief in fairy tales.

Now, if our orthogenetic perfecting principle is correct as shown in the evolution of the grain box in the Andropogoneæ, we may expect some interesting developments in case the evolutionary movement continues to its determinate limit; and since the rapid progression of zygomorphy of the flower is in evidence, this property will also be involved in the further enlargement and elongation of the connective. The genus Salvia represents about the extreme in the evolutionary progression of the flower in the Lamiaceæ, and fortunately there are about 500 species, so there is abundant opportunity for the orthogenetic series to reach the limit. *Salvia lyrata* L. (Fig. 6), although it has the connective enormously elongated, when compared with *Monarda didyma*, is nevertheless about the lowest of our native sages. From this species on the various Salvias fall into gradation series in respect to the lengthening of the anther connective until a very extreme development is reached. In *Salvia lyrata* the one arm of the connective with its anther-sac is much longer than the other. The anther-sac of the short arm is still functional but much reduced. This is due to the influence of the zygomorphic nature of the flower as a whole. The flower bud is evolving determinateness more rapidly on the one side than on the other. In this example we have the first prominent steps, which if continued will evolve a perfect lever-brush apparatus. That there is any advantage to the flower in the elongated connective and its one sided development with a consequent reduction in the amount of pollen available for pollination is not at all apparent. In fact if there is any effect which might influence survival, it

would have to be regarded as a decided disadvantage when compared with the first species given, belonging to Agastache, Teucrium, Clinopodium, and Satureia, all of which have 4 functional stamens although the flowers are all zygomorphic to a greater or less extent.

Figure 7 represents a stamen of the common sage, *Salvia officinalis* L. The movements which produced the stamen of *Salvia lyrata* are carried on further, so the connective is much longer and the reduced anther-sac is very small, approaching the vestigial condition. In *Salvia lanceifolia* Poir. (Fig. 8) the vestigial anther-sac has entirely disappeared and the entire connective is now in the form of a lever but still imperfectly developed. Figure 9 represents a stamen of *Salvia farinacea* Benth. In this form, any one can see a decided improvement over the last species; and *Salvia pitcheri* Torr. (Fig. 10) is a still further advance toward the ideal structure. In Pitcher's sage the brush and lever works very perfectly. In fact, so far as the ability of the mechanism to brush pollen on the insect's back is concerned, nothing more can be desired. But the orthogenetic, evolutionary movement can go farther still in the same direction, provided a lengthening factor appears to give the proper length of corolla tube. There is in the stamen mechanism itself nothing to place a definite limit to further advancement. So in *Salvia splendens* Ker-Gawl (Fig. 11) we find a much more extreme development of the mechanism, which was possible because of the introduction of a lengthening factor operative in the corolla and style. One would think that at this point the brush and lever mechanism had certainly attained the limit. But there is a further step possible. Not only can the length of the connective be augmented decidedly so long as the corolla and style continue to enlarge and elongate in their evolutionary course but with the advancement of the zygomorphic nature, there can be developed a decided difference between the brush arm and the handle arm of the lever. This is a simple principle of elementary mechanics. Now since the handle end of the lever necessarily projects down into the corolla tube, there is little room for movement even when it is pushed to the extreme limit. But if the arm of the lever which holds the anther-sac is decidedly lengthened then a small amount of movement at the handle will give a wide arc of movement in the brush end, which no doubt would facilitate the throwing out or sprinkling of the pollen on the back of the

visiting insect. This remarkable perfection is attained in *Salvia patens* Cav. (Fig. 12.).

Compare Fig. 6 with Fig. 12 and we are again passing from a crude beginning to the ultimate of perfection. Evolution is perfective. Yet there is no ecological advantage in all this. So far as a mechanism to insure pollination is concerned, *Agastache scrophulariaefolia* works just as perfectly as *Salvia lyrata* and this works just as well as *Salvia patens*. The matter of survival is not involved at all. Any one looking for such a condition is simply exercising his credulity in opposition to the biological facts and results. The insects involved were part of the environment while the evolution was taking place. Their presence made such an evolution possible but the ecological interaction was not the cause of the appearance of the special potentialities developed. We see that all the different steps in the process have survived because not a single change involved the problem of survival, and because evolution proceeds through individuals. Had the proper insects been completely eliminated from the environment there would have been no advance because of the ensuing struggle for perpetuation. The old alone would have remained; for the old continues as before. It is very important to grasp the significance of this fact. For none of the imaginary causal factors of evolution, reaction to environment, natural selection, use and disuse, or geographic barriers is in evidence. The only way in which environment enters into the problem is the fact that the environment holds efficient insect pollen carriers. Since the environment was thus present, the orthogenetic progression could proceed to the extreme limit of the extreme Salvias without encountering the factor of elimination. Without the proper environment the very first step, which made pollination dependent on the presence of certain kinds of insects, would have lead to destruction just as surely as the development of sterility in any individual line, whether plant, animal or human, necessarily brings an end of that particular line for all future time.

The three studies presented, which could easily be multiplied by the scores and hundreds, then plainly indicate that: Evolution is orthogenetic, perfective, and determinative.

EXPLANATION OF THE FIGURES OF PLATE I.

Fig. I. *Chaetochloa verticillata* (L.) Scribn., showing two retrorsely barbed bristles at the base of the pair of spikelets.

Fig. 2. *Chaetochloa imberbis* (Poir.) Scribn., with 10 bristles upwardly barbed.

Fig. 3. *Pennisetum glaucum* R. Br., with an involucre of stiff bristles and hairs around the expanded base of the pair of spikelets.

Fig. 4. *Cenchrus myosuroides* H. B. K., with a moderate development of the cortical expansion bearing a crown of prickles around the spikelets.

Fig. 5. *Cenchrus pauciflorus* Benth,. with a very pronounced cortical expansion and prominent prickles enclosing the two spikelets.

Fig. 6. *Cenchrus palmeri* Vas., with a very large development of the cortical expansion bearing large long prickles, the spikelets being entirely enclosed in this highly evolved bur.

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EXPLANATION OF THE FIGURES OF PLATE II.

Fig. 1. *Andropogon furcatus* Muhl. A rachis joint with sessile and stalked spikelets.

Fig. 2. *Hemarthria fasciculata* (Lam.) Kunth. Enlarged and slightly excavated rachis joint showing the stalk of the pedicellate spikelet united with its margin and the specialization of the outer empty glume of the sessile spikelet.

Fig. 3. *Coelorachis cylindrica* (Mx.) Nash. Deeply excavated and enlarged rachis joint showing the outer empty glume partly opened out to show the sessile spikelet and the stalked spikelet with vestigial glumes, situated at one side in front.

Fig. 4. *Tripsacum dactyloides* L. The highly evolved, enlarged and deeply excavated rachis joint showing the outer empty glume serving as a lid to the box and enclosing the spikelet with the grain.

Fig. 5. *Euchlaena mexicana* Schrad. Highly evolved, indurated, and perfected rachis joint enclosing the spikelets and grain completely, the indurated outer empty glume forming a closely fitting lid which is held down by the incurved edges of the box.

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EXPLANATION OF THE FIGURES OF PLATE III.

All the stamens are drawn to the same scale of magnification.

Fig. 1. *Agastache scrophulariaefolia* (Willd.) Ktz. An ordinary type of stamen with the two anther-sacs parallel and close together.

Fig. 2. *Teucrium occidentale* Gr., showing the anther-sacs somewhat divergent.

Fig. 3. *Clinopodium vulgare* L., showing the anther-sacs separated by the broadening of the connective.

Fig. 4. *Satureia hortensis* L. The anther-sacs are still farther apart.

Fig. 5. *Monarda didyma* L., showing a very prominent development of the connective with the anther-sacs divaricate.

Fig. 6. *Salvia lyrata* L., showing the connective greatly elongated, appearing like a cross-bar between the two anther-sacs, the one of which is becoming vestigial because of the evolution of zygomorphy.

Fig. 7. *Salvia officinalis* L. A more extreme development of the connective between the two anther-sacs, the one of which is decidedly reduced.

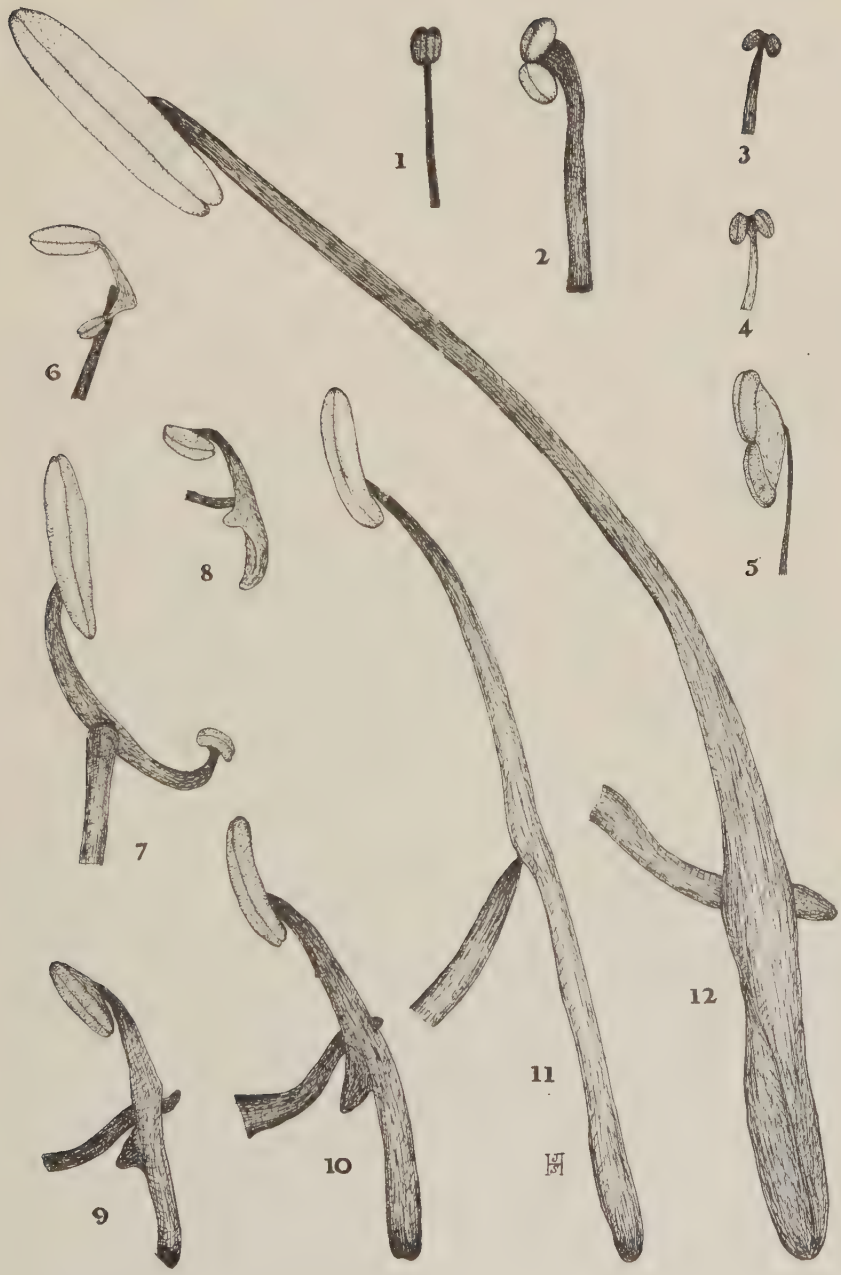
Fig. 8. *Salvia lanceifolia* Poir. The connective has evolved into a well developed lever-bar and the vestigial anther-sac has disappeared.

Fig. 9. *Salvia farinacea* Benth. The connective is longer and the handle end is more perfectly developed.

Fig. 10. *Salvia pitcheri* Torr. The connective is still longer and the apparatus works as an ingenious pollination device.

Fig. 11. *Salvia splendens* Ker-Gawl. The stamen has an enormously long connective, fitting with the long corolla tube.

Fig. 12. *Salvia patens* Cav. The connective is not only much longer than in any of the preceding but the brush end of the lever is very much longer than the handle end.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A KEY TO THE SPECIES, VARIETIES, AND FORMS OF THE ALGAL GENUS ŒDOGONIUM*.

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Although the writer has in an advance state of preparation a complete monographic report of the algal genus Oedogonium, it seems appropriate to present at this time a key to all forms known, together with a few notes on some recent changes and additions to the taxonomic nomenclature of the genus. It is candidly admitted at the outset that any key not illustrated is well-nigh "an abomination unto science." It is equally true, on the other hand, that an attempt to include all the species, varieties, and forms of a genus as large as Oedogonium into a workable key is not without its difficulties. A very earnest effort has been made to examine all the literature pertinent to the subject. In all probability some species have been omitted. The writer will appreciate very much having his attention called to any members of the genus not included herewith. In fact, any correction or suggestion regarding the key and its workability will be most welcome; thus, a preliminary report seems desirable.

The key has been made with the deliberate aim of helping the student of the genus to name his collection. Morphological relationships have been severed whenever it was felt that the alga could be identified more readily in another association. The key has been considerably revised since its first draft nearly six years ago, and the writer is grateful to his students and colleagues for their constructive criticisms. If the name of the alga is followed by an asterisk, it signifies that the description is incomplete and hence the position in the key only a probability.

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* Papers from the Department of Botany, the Ohio State University, No. 232.

THE KEY.

1. Vegetative cell undulate or nodulose 2
1. Vegetative cell punctate or granulate 6
1. Vegetative cell distinctly capitellate 7
1. Vegetative cell cylindrical 35
1. Vegetative cell subhexagonal or subellipsoid ..... *Oe. reinschii**
   2. Without dwarf male 3
   2. With dwarf male 4
3. Diameter of oogonium 18–23μ ..... *Oe. sphaerandrium*
3. Diameter of oogonium 48–57μ ..... *Oe. nodulosum*
3. Diameter of oogonium 64–74μ ..... *Oe. nodulosum* var. *commune*
   4. Diameter of oogonium 44–56μ 5
   4. Diameter of oogonium 58–68μ ..... *Oe. undulatum* var. *americanum*
5. Dwarf male 36–46μ in length ..... *Oe. undulatum* f. *senegalense*
5. Dwarf male 48–70μ in length ..... *Oe. undulatum*
   6. Diameter of vegetative cell 6–8μ ..... *Oe. elegans*
   6. Diameter of vegetative cell 9–13μ ..... *Oe. minus*
   6. Diameter of vegetative cell 16–22μ ..... *Oe. punctatostriatum*
7. Without dwarf male 8
7. With dwarf male 17
7. Reproductive structures imperfectly known 34
   8. Dioecious 9
   8. Monoecious 11
9. Division of oogonium basal ..... *Oe. infimum*
9. Division of oogonium inferior ..... *Oe. inversum*
9. Division of oogonium median 10
   10. Oogonium 26–29μ in diameter ..... *Oe. howardii* var. *minus*
   10. Oogonium 29–32μ in diameter ..... *Oe. howardii*
   10. Oogonium 32–36μ in diameter ..... *Oe. latiusculum*
11. Oogonium opening by a pore ..... *Oe. hirnii* var. *africanum*
11. Oogonium opening by a lid 12
   12. Diameter of oogonium 15–25μ 13
   12. Diameter of oogonium 34–46μ 16
13. Division of oogonium median 14
13. Division of oogonium supramedian 15
   14. Oogonium subdepressed-globose ..... *Oe. capitellatum*
   14. Oogonium angular-globose ..... *Oe. quadratum*
15. Diameter of oogonium 15–20μ ..... *Oe. virceburgense**
15. Diameter of oogonium 18–23μ ..... *Oe. sphaerandrium*
15. Diameter of oogonium 26–29μ ..... *Oe. spurium**
   16. Vegetative cell punctate ..... *Oe. minus*
   16. Vegetative cell not punctate ..... *Oe. bohemicum*
17. Poriferous ..... *Oe. nebraskense*
17. Operculate 18
   18. Division of oogonium median 19
   18. Division of oogonium supramedian 24
   18. Division of oogonium inframedian 26
   18. Division of oogonium superior ..... *Oe. rigidum*
   18. Division of oogonium supreme 29
19. Division of oogonium narrow 20
19. Division of oogonium wide 21
   20. Oogonium 28–35 × 23–38μ ..... *Oe. decipiens* f. *dissimile*
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WITHOUT DWARF MALES, OPERCULATE OOGONIUM, CYLINDRICAL VEGETATIVE CELLS.

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NOTES ON NEW FORMS.

In analyzing the members of the genus *Oedogonium* it seems necessary in the interest of completeness and simplicity to recognize the new forms and combinations described below. Insofar as the notes of the writer are complete, this brings the genus up to date.

Oe. borisianum (Le Cl.) Wittr. var. *westii* Tiffany & Brown, nov. var.
Oe. Borisianum (Le Cl.) Wittr. *in* West and West, 1903, p. 36.

Larger dimensions throughout; vegetative cell 17–19 × 130–180μ; suffultory cell 31–42 × 105–168μ; oogonium 53–60 × 67–88μ; oospore 49–58 × 49–58μ; antheridium 17 × 12–13μ.

England; Mississippi (U. S. A.)

Oe. decipiens Wittr. var. *africanum* nov. var.
Oe. decipiens forma West and West, 1897, p. 5; Hirn, 1900, p. 267, Pl. XLVI, Fig. 284.

A little smaller than the type and idioandrosporous; vegetative cell 8–13 × 25–60μ; oogonium 25–32 × 24–32μ; oospore 24–30 × 23–28μ; androsporangium 7–11 × 9–13μ; dwarf male 6–7 × 9–12μ.

Africa.

Oe. dictyosporum Wittr. f. *westii* nov. f.
Oe. dictyosporum Wittr. *forma* West, 1907, p. 98.

Oogonium and oospore ovate-ellipsoid, a little larger than the type; vegetative cell 14–16 × 50–80μ; oogonium 42 × 52μ; oospore 40 × 50μ; antheridium 13 × 8–9μ.

Africa.

Oe. hystrix Wittr. var. *canadense* nov. var.
(?) *Oe. hystrix* Wittr. *in* Skuja, 1927, Pl. II, Fig. 13.

Pore inframedian; vegetative cell 14–25 × 80–125μ; suffultory cell 24–30 × 64–72μ; oogonium 40–53 × 52–64μ; oospore 38–48 × 40–60μ; androsporangium 16–20 × 15–30μ; antheridium 7–8 × 8–14μ; dwarf male stipe 9–12 × 28–40μ.

All of the individual plants of *Oe. hystrix* that I have seen had the median pore as a very constant characteristic. In material sent me by Mr. G. H. Wailes from British Columbia occurred a form along with the type, having the pore uniformly below the median position. This together with differences in size seems to warrant a new variety. The form figured by Skuja very probably should be referred to this variety, although the dimensions are not quite the same.

British Columbia; (?) Latvia.

Oe. intermedium Wittr. var. *fennicum* nov. var.
Oe. intermedium Wittr. *forma valida* Hirn, 1900, p. 95, Pl. V, Fig. 32; *Oe. intermedium* Wittr. *forma* West, 1909, p. 239.

Oogonium and oospore considerably larger; vegetative cell 17–19 × 50–120μ; oogonium 38–46 × 42–60μ; oospore 35–40 × 35–40μ; antheridium 13–18 × 6–8μ.

Finland; Egypt; Michigan (U. S. A.).

Oe. macrandrium Wittr. var. *hohenackerii* (Wittr.) nov. comb.

Oe. Hohenackerii Wittrock, 1874, p. 23; *Oe. tumidulum* in *Hohenacker* Alg. Exs. No. 404; *Oe. Hohenackerii* Wittr. *in* Hirn, 1900, p. 238, Pl. XL, Fig. 246.

Vegetative cell 12–15 × 24–45μ; oogonium 29–33 × 30–35μ; oospore 27–31 × 28–31μ; androsporangium 11–13 × 10–14μ; dwarf male stipe 9–14 × 18–24μ; antheridium 5–6 × 5–8μ.

A collection of this interesting member of the genus from Michigan by Miss Alma B. Ackley helped to establish definitely that it belongs with the *macrandrium* group. Its shorter vegetative cells constitute its chief distinctive characteristic, but it seems to occur regularly.

India; Massachusetts and Michigan (U. S. A.).

Oe. rufescens Wittr. var. *lundellii* (Wittr.) nov. comb.

This variety was originally described by Wittrock (1872, p. 32) as *Oe. Lundellii*. It is considered as a subspecies of *Oe. rufescens* by Hirn (1900, p. 77, Pl. I, Fig. 6). It clearly belongs with *rufescens*, but I can see no necessity of maintaining the division "subspecies" in the nomenclature of the genus. Its dimensions are very near those of the species proper, but its slightly wider vegetative cells in proportion to oogonia and the depressed-globose appearance of the oogonia, which are quite constant, perhaps warrant a varietal rank.

Oe. spirale Hirn var. *latviense* nov. var.

Oe. spirale Hirn f. in Skuja, 1927, p. 102, Pl. II, Fig. 14, a, b.

Pore supramedian or superior; vegetative cell 16–20 × 65–120μ; oogonium 49–60 × 65μ; oospore (without ribs) 35–45 × 35–45μ, not filling oogonium, outer wall with 5 to 6 spirally arranged ribs; dwarf male 12 × 50μ.

The above description of the alga, as given by Skuja for the Latvian material, seems to warrant varietal rank.

Latvia.

Oe. capilliforme Kuetz.; Wittr. var. *diversum* (Hirn) nov. comb.

Oe. capilliforme Kuetz.; Wittr. var. *australe* Wittr. f. *diversum*, Hirn, 1900, p. 110, Pl. IX, Fig. 54; *Oe. stagnale* Kuetz. *in* Tilden Amer. Algæ, 1896.

Dimensions larger throughout; female vegetative cell 34–46 × 45–130μ; male vegetative cell 33–40 × 50–120μ; oogonium 46–56 × 46–70μ; oospore 43–52 × 40–58μ; antheridium 30–37 × 6–11μ.

U. S. A.: Colorado, Iowa.

ALPHABETICAL LIST OF SPECIES, VARIETIES, AND FORMS.

The following is a complete list of all members of *Oedogonium* thought to have a tenable position in the genus. A few species with very incomplete and unsatisfactory descriptions are not included. They will be discussed in the monographic report.

In working through a genus as large as *Oedogonium*, one finds it quite difficult to pass on the validity of some members. Such decisions, while always influenced to some extent by personal interpretations, must rest upon one's knowledge of all species and their variations.

The ultimate criterion must be the constancy of such characteristics as methods of reproduction, size (within limits), shape of cells, opening of oogonia, etc. How much are all these altered by ecological conditions of the body of water in which the algæ are growing? Unfortunately our data here are far from complete. When one finds a combination of the same characteristics in a given alga year after year in various habitats, one can be reasonably sure of the constancy of the species.

If an alga occurs year after year in the same habitat with a known species, differing in one or more morphological characteristics but evidently closely related to the type, it should be classed as a "variety." As an example, the robust variety (*majus*) of *Oe. grande* has been collected with the type in nearly all collections from the United States. Such differences can hardly be accounted for on the basis of environmental influences.

The category "form" ("forma" of Hirn) should be regarded as a temporary disposition only. If an alga varies from the description of a given species and has been seen only once or twice, it is hardly possible to know whether the variation is constant or merely an ecological variation. If the form occurs with the type and is found on several occasions to maintain its morphological variation, it should be raised to varietal rank. A "form" then should be retained only when the data are insufficient to pass on the constancy of the variations noted in the description.

The following list is based on the above interpretation.

1. *acmandrium* Elfv.
2. *acrosporum* De Bary.
3. " f. *boreale* (Wolle) Hirn.
4. " var. *bathmidosporum* (Nord.) Hirn.
5. *acrosporum* var. *floridense* Wolle.
6. " var. *majusculum* Nordst.
7. *ahlstrandii* Wittr.
8. *alternans* Wittr. & Lund.
9. *americanum* Transeau.
10. *angustissimum* West & West.
11. *anomalum* Hirn.
12. *arcyosporum* Nor. & Hirn.
13. *areolatum* Lagerheim.
14. *areschougii* Wittr.
15. " var. *americanum* Tiffany
16. " f. *robustum* Hirn.
17. *argenteum* Hirn.
18. *armigerum* Hirn.
19. *aster* Wittr.
20. *australianum* Hirn.
21. *autumnale* Wittr.
22. *bahusiense* Nordst.
23. *bengalense* Hirn.
24. *biforme* Nordst.
25. *bohemicum* Hirn.
26. *boreale* Hirn.
27. *borisianum* (Le Cl.) Wittr.
28. " var. *westii* Tiffany & Brown.
29. *boscii* (Le Cl.) Wittr.
30. *boscii* (Le Cl.) Wittr. f. *dispar* Hirn.
31. " var. *notabile* Lemm.
32. " var. *occidentale* Hirn.
33. *brasiliense* Borge.
34. *braunii* Kuetz.; Pringsh.
35. " var. *hafniense* (Hallas) Hirn.
36. " var. *zehneri* Tiffany.
37. *calcareum* Cleve.
38. *capense* Nordst. & Hirn.
39. *capillare* (L.) Kuetz.
40. " f. *stagnale* (Ktz.; Wittr.) Hirn.
41. *capilliforme* Kuetz.; Wittr.
42. " f. *debaryanum* (Chmiel.) Hirn.
43. *capilliforme* f. *lorentzii* (M. & W.) Hirn.
44. *capilliforme* var. *australe* Wittr.
45. " var. *diversum* (Hirn) Tiffany.
46. *capitellatum* Wittr.
47. *cardiacum* (Hass.) Wittr.
48. " f. *interjectum* Hirn.
49. " f. *pulchellum* (Hass.) Hirn.
50. " var. *carbonicum* Wittr.
51. " var. *minor* Lemm.
52. *cataractum* Wolle.
53. *ciliatum* (Hass.) Pringsh.
54. *clavatum* Hallas.
55. *cleveanum* Wittr.
56. " f. *exoticum* Hirn.
57. *concatenatum* (Hass.) Wittr.
58. *concatenatum* f. *hutchinsiæ* (Wittr.) Hirn.
59. *concatenatum* var. *rectangulare* Rich.
60. *confertum* Hirn.
61. *consociatum* Collins & Hervey.
62. *contortum* Hallas.
63. *costatum* Transeau, Mss.
64. *crassiusculum* Wittr.
65. " var. *arechavaletæ* (Wittr.) Hirn.
66. *crassiusculum* var. *idioandrosporum* Nor. & Wtr.
67. *crassum* (Hass.) Wittr.
68. " f. *amplum* (Magnus & Wille) Hirn.
69. *crassum* var. *longum* Transeau.
70. " var. *subtumidum* Hirn.
71. *crenulatocostatum* Wittr.
72. " f. *cylindricum* Hirn.
73. *crenulatocostatum* var. *aureum* Tilden.
74. *crenulatocostatum* var. *longiarticulatum* Hansg.
75. *crenulatum* Wittr.
76. " var. *gracilius* (Nordst.) Hirn.
77. *crispum* (Hass.) Wittr.
78. " f. *granulosum* (Nordst.) Hirn.
79. *crispum* f. *inflatum* Hirn.
80. " var. *gracilescens* Wittr.
81. " var. *hawaiense* Nordst.
82. " var. *uruguayense* Magnus & Wille.
83. *cryptoporum* Wittr.
84. " var. *vulgare* Wittr.
85. *curtum* Wittr. & Lund.
86. *curvum* Pringsheim.
87. *cyathigerum* Wittr.
88. " f. *americanum* Wolle.
89. " f. *ornatum* (Wittr.) Hirn.
90. *cyathigerum* f. *perfectum* Hirn.
91. " var. *ellipticum* M.& W.
92. " var. *hormosporum* (West) Hirn.
93. *cymatosporum* Wittr. & Nordst.
94. *danicum* Hallas.
95. *decipiens* Wittr.
96. " f. *dissimile* Hirn.
97. " var. *africanum* Tiffany.
98. " var. *bernardense* (Bates) Hirn.
99. *depressum* Pringsh.
100. *dictyosporum* Wittr.
101. " f. *westii* Tiffany.
102. *dioicum* Carter.
103. *donnellii* Wolle; Hirn.
104. " var. *wittrockiana* Hirn.
105. *echinatum* (Wood) Wittr.
106. *echinospermum* Al. Br.
107. " var. *horridum* Hirn.

108. *elegans* West & West.
109. *excisum* Wittr. & Lund.
110. *exocostatum* Tiffany.
111. *exospirale* Tiffany.
112. *fabulosum* Hirn.
113. " var. *maximum* (West) Hirn.
114. *fabulosum* var. *punctatum* Lemm.
115. *flavescens* (Hass.) Wittr.
116. *flexuosum* Hirn.
117. *fonticola* Al. Braun.
118. *foveolatum* Wittr.
119. *fragile* Wittr.
120. " var. *abyssinicum* Hirn.
121. *franklinianum* Wittr.
122. *fusus* Hallas.
123. *gallicum* Hirn.
124. *geniculatum* Hirn.
125. *giganteum* Kuetz.; Wittr.
126. *glabrum* Hallas.
127. *globosum* Nordst.
128. *gracillimum* Wittr. & Lund.
129. " f. *majus* West & West.
130. *grande* Kuetz.; Wittr.
131. " f. *gemelliparum*(Pring).Hirn.
132. " var. *aequatoriale* Wittr.
133. " var. *angustum* Hirn.
134. " var. *majus* Hansg.
135. *gunnii* Wittr.
136. *hians* Norst. & Hirn.
137. *hirnii* Gutwinski.
138. " var. *africanum* G. S. West.
139. *hispidum* Nordst.
140. *hoehnei* Borge.
141. *hoersholmiense* Hallas.
142. *howardii* G. S. West.
143. " var. *minus* Tiffany.
144. *huntii* Wood.
145. *hystricinum* Transeau & Tiffany.
146. *hystrix* Wittr.
147. " var. *canadense* Tiffany.
148. " var. *subglobosum* Wittr.
149. *illinoiense* Transeau.
150. *implexum* Hirn.
151. *inconspicuum* Hirn.
152. *indicum* Hirn.
153. *inerme* Hirn.
154. " var. *mentiens* Hirn.
155. *infimum* Tiffany.
156. *inflatum* Hallas.
157. *insigne* Hirn.
158. *intermedium* Wittr.
159. " var. *fennicum* Tiffany.
160. *inversum* Wittr.
161. *iowense* Tiffany.
162. *irregulare* Wittr.
163. " var.*condensatum*(Hallas) Hirn.
164. *itzigsohnii* De Bary.
165. " f. *heteromorphum* Hirn.
166 " var. *minus* West.
167. *kirchneri* Wittr.
168. *kitutæ* G. S. West.
169. *kjellmanii* Wittr.; Hirn.
170. *kurzii* Zeller.
171. *laetevirens* Wittr.
172. *laeve* Wittr.
173. *lageniforme* Hirn.
174. *lagerstedtii* Wittr.
175. *landsboroughi* (Hass.) Wittr.
176. " var. *norvegicum* Wittr.
177. *latiusculum* Tiffany.
178. *lautumniarum* Wittr.
179. *leiopleurum* Nordst. & Hirn.
180. *lindmanianum* Wittr.
181. *longatum* Kuetz.
182. *longicolle* Nordst.; Hirn.
183. " var. *senegalense* Nordst.
184. *loricatum* Hirn.
185. *macrandrium* Wittr.
186. " f. *acuminatum* Hirn.
187. " f. *aemulans* Hirn.
188. " f. *lundense* (Wittr.) Hirn.
189. *macrandrium* var. *propinquum* (Wittr.) Hirn.
190. *macrandrium* var. *hohenackerii* (Wittr.) Tiffany.
191. *macrandrium* var. *scrobiculatum* Ackley, Mss.
192. *macrospermum* West & West.
193. *magnusii* Wittr.
194. *mammiferum* Wittr.; Nordst.
195. *manschuricum* Skvortzow.
196. *margaritiferum* Nordst. & Hirn.
197. *martinicense* Hirn.
198. *megaporum* Wittr.; Hirn.
199. *mexicanum* Wittr.
200. *michiganense* Tiffany.
201. *minus* Wittr.
202. *mirandrium* Skuja.
203. *mitratum* Hirn.
204. *monile* Berk. & Harv.; Wittr.
205. " f. *borgei* Hirn.
206. " var. *eminens* Hirn.
207. " f. *victoriense* G. S. West.
208. *moniliforme* Wittr.
209. *montagnei* Fiorini-Mazzanti; Wittr.
210. *multisporum* Wood.
211. " var. *magnum* Ackley, Mss.
212. *nanum* Wittr.; Tiffany.
213. *nebraskense* Ohashi.
214. *nobile* Wittr.
215. " var. *minus* Hirn.
216. *nodulosum* Wittr.
217. " var. *commune* Hirn.
218. *obesum* (Wittr.) Hirn.
219. *oblongellum* Kirch.
220. *oblongum* Wittr.
221. " f. *majus* (Nordst.) Hirn.
222. " f. *sphaericum* (Hallas) Hirn.
223. *oboviforme* Wittr.
224. *obsoletum* Wittr.

225. *obtruncatum* Wittr.
226. " var. *completum* Hirn.
227. " var. *ellipsoideum* Wittr.
228. *oelandicum* Wittr.
229. " f. *minus* Borge.
230. *oryzæ* Wittr.
231. " var. *seriosporum* (Lager.) Hirn.
232. *oviforme* (Lewin) Hirn.
233. *pachyandrium* Wittr.
234. *pachydermum* Wittr. & Lund.
235. *paludosum* (Hass.) Wittr.
236. " var. *americanum* Nordst.
237. " var. *parvisporum* Hirn.
238. *paucocostatum* Transeau.
239. " var. *gracilis* Tiff.
240. *paulense* Nordst. & Hirn.
241. *perspicuum* Hirn.
242. *petri* Wittr.
243. *pisanum* Wittr.
244 " var. *gracilis* Trans. & Tiff.
245. *pithophoræ* Wittr.
246. *plagiostomum* Wittr.
247. " var. *gracilius* Wittr.
248. *platygynum* Wittr.
249. " f. *obtusum* Hirn.
250. " var. *continuum* Nordst.
251. " var. *novæ zelandiæ* Hirn.
252. *plicatulum* Wittr.
253. *plusiosporum* Wittr.
254. *pluviale* Nordst.
255. *poecilosporum* Nordst. & Hirn.
256. *porrectum* Nordst. & Hirn.
257. *pratense* Transeau.
258. *praticolum* Transeau.
259. *princeps* (Hass.) Wittr.
260. *pringsheimii* Cramer; Wittr.
261. " var. *abbreviatum* Hirn.
262. *pringsheimii* var. *nordstedtii* Wittr.
263. *psaegmatosporum* Nordst.
264. *pseudacrosporum* Wittr.
265. *pseudoboscii* Hirn.
266. *pulchrum* Nordst. & Hirn.
267. *punctatostriatum* De Bary.
268. *punctatum* Wittr.
269. *pungens* Hirn.
270. *pusillum* Kirchner.
271. *pyriforme* Wittr.
272. *pyrulum* Wittr.
273. *quadratum* Hallas.
274. *reinschii* Roy.
275. *rhodosporum* (Welwitsch) Wittr.
276. *richterianum* Lemm.
277. *rigidum* Hirn.
278. *rivulare* (Le Cl.) Al. Br.
279. *rothii* (Le Cl.) Pringsheim.
280. *rufescens* Wittr.
281. " f. *exiguum* (Elfving) Hirn.
282. " var. *lundellii* (Wittr.) Tiff.
283. *rugulosum* Nordst.
284. " f. *minutum* (Hansg.), Hirn.
285. *rugulosum* f. *rotundatum* Hirn.
286. *rupestre* Hirn.
287. " f. *pseudautumnale* Hirn.
288. *sancti thomæ* Wittr. & Cleve.
289. *schmidlei* Gutwinski.
290. *scrobiculatum* Wittr.
291. *selandiæ* Hallas.
292. *semiapertum* Nordst. & Hirn.
293. *sexangulare* Cleve.
294. " var. *angulosum* (Hallas) Hirn.
295. *sexangulave* var. *majus* Wille.
296. *silvaticum* Hallas.
297. *simplex* Hirn.
298. *sociale* Wittr.
299. *sodiroanum* Lagerheim.
300. *sol* Hirn.
301. *spectabile* Hirn.
302. *sphaerandrium* Wittr. & Lund.
303. *spirale* Hirn.
304. " var. *acutum* G. S. West.
305. " var. *latviense* Tiffany.
306. *spurium* Hirn.
307. *stellatum* Wittr.
308. *suboctangulare* G. S. West.
309. *subrectum* Hirn.
310. *suecicum* Wittr.
311. " f. *australe* G. S. West.
312. *supremum* Tiffany.
313. *tapeinosporum* Wittr.
314. *taphrosporum* Nordst. & Hirn.
315. *tentoriale* Nordst. & Hirn.
316. *tiffanii* Ackley, Mss.
317. *trioicum* Woronichkin.
318. *tumidulum* (Kuetz.) Wittr.
319. *tyrolicum* Wittr.
320. *uleanum* Hirn.
321. *undulatum* (Breb.) Al. Br.; Wittr.
322. " var. *americanum* Transeau.
323. *undulatum* f. *senegalense* (Nordst). Hirn.
324. *upsaliense* Wittr.
325. " var. *fennicum* Hirn.
326. *urbicum* Wittr.
327. *urceolatum* Nordst. & Hirn.
328. *varians* Wittr. & Lund.
329. *vaucherii* (Le Cl.) Al. Br.; Wittr.
330. *velatum* Hallas.
331. *verrucosum* Hallas.
332. *vesicatum* (Lyngbye) Wittr.
333. *victoriense* G. S. West.
334. *virceburgense* Hirn.
335. *wabashense* Tiffany.
336. *warmingianum* Wittr.
337. *welwitschii* West.
338. *wolleanum* Wittr.
339. " f. *insigne* (Nordst.) Hirn.
340. " var. *concinnum* Hirn.
341. *wyliei* Tiffany.
342. *zigzag* Cleve.
343. " var. *robustum* West.
344. *pyrulum* var. *amplius* W.R. Taylor.

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ADDITIONS TO THE CATALOG OF OHIO VASCULAR PLANTS FOR 1928.*

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By the continued activity of the botanists of the state many rare specimens have been added to the state herbarium. The more important are listed below with the names of the donors. The writer, as in the past, takes the responsibility for the determinations. In the past year R. G. Adams and Co., of Columbus, Ohio, have published the writer's "Field Manual of the Flora of Ohio and Adjacent Territory." This Manual can be used as a check list as well as for identification and taxonomy until a new catalog of Ohio plants is published. It is hoped that the forthcoming Botanical Congress, to be held in Cambridge, England, will establish a better system of rules of nomenclature and that a new Catalog of Ohio Vascular Plants, brought up to date, can then be published.

4. *Botrychium lanceolatum* (Gmel.) Angs. Lanceleaf Grape-fern Gustavus Twp., Trumbull Co. Lawrence E. Hicks.

25. *Asplenium ruta-muraria* L. Wall-rue Spleenwort. Change name to *Asplenium cryptolepis* Fern. American Wall-rue Spleenwort. Distribution—Highland Co., two localities, Adams Co. The specimen from Adams Co. collected by Mrs. Bayard Taylor, is somewhat intermediate between the species and the variety given below. Add also to record, Cedar Falls, Jefferson Twp., Adams Co. Apparently typical specimens of the species collected in 1928 by R. B. Gordon, Conrad Roth, and E. Lucy Braun.

25a. *Asplenium cryptolepis ohionis* Fern. Ohio Wall-rue Spleenwort. In Clifton Gorge, Clifton, Greene Co. Specimens in the herbarium collected at various intervals, the first in 1873 by Hannah Jane Biddlecombe. Several years ago Miss Biddlecombe called my attention to the peculiar plant from Clifton Gorge and said that she thought it was a new variety or new species. Years ago she had expressed this opinion to a prominent eastern systematic botanist, but he never took up the matter. I was preparing to describe it and to name it for its discoverer, Miss Biddlecombe, having already made sketches and partial descriptions. In the meantime Fernald has finally

* Papers from the Department of Botany, The Ohio State University No. 234.

given it a name. The juvenile form is practically indistinguishable from the species, but the mature leaves are strikingly different.

53. *Equisetum laevigatum* A. Br. Smooth Scouring-rush. West of Holland, Lucas Co. E. L. Moseley.

53.1. *Equisetum kansanum* Schaffn. Kansas Scouring-rush. Along interurban railway track and in prairie below. East of Harmony, Clark Co. John H. Schaffner.

54. *Equisetum fluviatile* L. Water Horsetail. Neapolis, Lucas Co. E. L. Moseley.

58. *Lycopodium lucidulum* Mx. Shining Club-moss. Swanton, Fulton Co. E. L. Moseley.

60. *Lycopodium inundatum* L. Bog Club-moss. "Sand pit," Holland, Lucas Co. E. L. Moseley and Edgar Hovey.

61. *Lycopodium clavatum* L. Common Club-moss. Northern Trumbull Co. Lawrence E. Hicks.

63. *Lycopodium complanatum* L. Trailing Club-moss. North part of Trumbull Co. Lawrence E. Hicks. Chillicothe, Ross Co. M. G. Dickey.

75. *Juniperus virginiana* L. Red Juniper. Staminate tree blown over, but still with root connection on one side. Covered with staminate cones and here and there a normal carpellate cone (sex-reversal). On Alum creek, about seven miles east of Delaware, Delaware Co. Glenn W. Blaydes.

139.1. *Cyperus ovularis* (Mx.) Torr. Globose Cyperus. Higby Prairie, Ross Co. Floyd Bartley and E. S. Thomas.

146. *Kyllinga pumila* Mx. Low Kyllinga. Monclova, Lucas Co. E. L. Moseley.

159. *Fimbristylis autumnalis* (L.) R. & S. Slender Fimbristylis. Hillsboro, Highland Co. Katie M. Roads.

159.1. *Hemicarpha micrantha* (Vahl.) Pax. Common Hemicarpha. "In a ditch on east and west road west of Monclova," Lucas Co. E. L. Moseley.

176. *Rynchospora glomerata* (L.) Vahl. Clustered Beak-rush. Holland, Lucas Co. E. L. Moseley.

184.1. *Carex texensis* (Torr.) Bail. Texas Sedge. On lawn, forming a turf, Columbus, Franklin Co. Apparently introduced from the south. "When established, forms nearly pure stands." A. E. Waller.

202. *Carex canescens* L. Silvery Sedge. Ten miles south of Monroeville, Huron Co. E. L. Moseley.

216.2. *Carex suberecta* (Olney) Britt. Prairie Straw Sedge. "In a swamp," Hillsboro, Highland Co. Katie M. Roads.

231. *Carex aurea* Nutt. Golden-fruited Sedge. "Along a ditch five miles north of Monclova," Lucas Co. Specimens also from "Blue Hole," Castalia, Erie Co. E. L. Moseley.

236. *Carex platyphylla* Car. Broad-leaf Sedge. Spring Valley, near Granville, Licking Co. A. E. Waller.

245. *Carex crawei* Dew. Crawe's Sedge. Bowling Green, Wood Co. E. L. Moseley.

248. *Carex conoidea* Schk. Field Sedge. Vermilion R., Florence Twp., Erie Co. E. L. Moseley.

252. *Carex gracillima* Schw. Graceful Sedge. "In swamp woods," Union Twp., Highland Co. Katie M. Roads.

292. *Carex intumescens* Rudge. Bladder Sedge. "In a swamp." Union Twp., Highland Co. Katie M. Roads.

295.1. *Arundinaria tecta* (Walt.) Muhl. Small Cane. A large patch growing spontaneously in a swamp near Otterbein Home, about four miles from Lebanon, Warren Co. "Stems 1.5–4.5 m. high and .5—1+ cm. in diameter. Tips winter-killed." F. A. McClure.

302. *Bromus inermis* Leyss. Hungarian Brome-grass. "Collected along the railroad track." Hillsboro, Highland Co. Katie M. Roads.

303. *Bromus ciliatus* L. Fringed Brome-grass. Whitehouse, Lucas Co. E. L. Moseley.

330. *Poa alsodes* Gr. Grove Meadow-grass. "In woods," near Hillsboro, Highland Co. Katie M. Roads.

334. *Eragrostis pectinacea* (Mx.) Steud. Purple Love-grass. Zanesville, Muskingum Co. C. A. Butler. Buchtel, Athens Co. Len. Stephenson.

349. *Phragmites phragmites* (L.) Karst. Common Reed-grass. Along Pymatuning R., Northern Trumbull Co. Lawrence E. Hicks.

359. *Nothoholcus lanatus* (L.) Nash. Velvet-grass. Wayne Twp., Ashtabula Co. Lawrence E. Hicks.

372a. *Hordeum vulgare trifurcatum* Schlecht. Hooded Barley. Penn Twp., Highland Co. Katie M. Roads.

375. *Hordeum jubatum* L. Squirrel-tail Barley. "In a pasture lot." Hillsboro, Highland Co. Katie M. Roads.

383. *Sporobolus asper* (Mx.) Kunth. Longleaf Rush-grass. Pike Twp., Madison Co. E. N. Transeau and E. S. Thomas.

391.1. *Agrostis perennans* (Walt.) Tuck. Upland Bent-grass. New Vienna, Clinton Co. Katie M. Roads.

396. *Alopecurus geniculatus* L. Marsh Foxtail. "Along roadside ditch." Fredericktown, Knox Co. Lawrence E. Hicks.

410. *Aristida dichotoma* Mx. Poverty-grass. Hocking Co. E. S. Thomas, A. E. Harper and E. L. Moseley.

414. *Torresia odorata* (L.) Hitchc. Vanilla-grass. "In a swampy place in a small wood." Union Twp., Highland Co. Katie M. Roads.

417. *Anthoxanthum odoratum* L. Sweet Vernal-grass. "Damp woodland clearing near Pymatuning R." Northern Trumbull Co. Lawrence E. Hicks.

419. *Panicum agrostoides* Spreng. Agrostis-like Panic-grass. Northern Trumbull Co. Andover, Ashtabula Co. Lawrence E. Hicks.

423. *Panicum miliaceum* L. Millet Panic-grass. "Along the railroad." Hillsboro, Highland Co. Katie M. Roads.

426. *Panicum flexile* (Gatt.) Scrib. Wiry Panic-grass. Marshall Twp., Highland Co. Katie M. Roads.

428. *Panicum depauperatum* Muhl. Starved Panic-grass. Midway, Lucas Co. E. L. Moseley.

433. *Panicum polyanthes* Schultes. Many-flowered Panic-grass. Hocking Co. E. S. Thomas and E. L. Moseley.

436. *Panicum boreale* Nash. Northern Panic-grass. Midway, Lucas Co. E. L. Moseley.

441. *Panicum tsugetorum* Nash. Hemlock Panic-grass. Swanton, Fulton Co. E. L. Moseley.

443. *Panicum scribnerianum* Nash. Scribner's Panic-grass. Midway, Lucas Co. E. L. Moseley.

448a. *Panicum boscii molle* (Vas.) Hitch. and Ch. "Upland hydrophytic forest," North College Hill, Hamilton Co. E. Lucy Braun.

456.1. *Paspalum circulare* Nash. Round-flowered Paspalum. "Very abundant in a pasture lot in a low place." Hillsboro, Highland Co. Katie M. Roads. Also prairie near Higby, Ross Co. Floyd Bartley and E. S. Thomas. Buchtel, Athens Co. Len. Stephenson.

468. *Miscanthus sinensis* Anderss. Chinese Plume-grass. "Escaped one mile north of Orwell," Ashtabula Co. Lawrence E. Hicks.

469.1. *Andropogon elliotii* Chapm. Elliott's Beard-grass. Buchtel, Athens Co. Len Stephenson. Section 23, Hocking Twp., Fairfield Co. "Along with *A. virginicus* L." E. S. Thomas and L. E. Hicks.

499. *Chamaelirium luteum* (L.) Gr. Chamaelirium. Savageville School, Jackson Co. "On a west slope." Lois Lampe.

504. *Trillium declinatum* (Gr.) Gleason. Drooping Trillium. White flowered variety. Fredericktown, Knox Co. Lawrence E. Hicks.

511.1. *Disporum maculatum* (Buckl.) Britt. Spotted Disporum. With dark purple spots on the perianth segments and long anther filaments. A mere fragment, but undoubtedly this species. Near Waverly, Pike Co. Beryl Finney.

545. *Juncus torreyi* Cov. Torrey's Rush. Licking Narrows, Licking Co. R. B. Gordon. Along Pymatuning R., Northern Trumbull Co. Williamsfield Twp., Ashtabula Co. Lawrence E. Hicks.

549. *Juncus canadensis* J. Gay. Canada Rush. Spencer Twp., Lucas Co. E. L. Moseley.

556.1. *Narcissus poeticus* L. Poet's Narcissus. Native of Europe. "In a field." Hillsboro, Highland Co. Also in Marshall Twp., along road (double flowered variety). Katie M. Roads.

556.2. *Narcissus pseudo-narcissus* L. Daffodil. Native of Europe. "Propagates itself readily in neglected yards and near-by waste places." Hillsboro, Highland Co. Katie M. Roads.

557.3. *Iris foliosa* Mack. and Bush. Leafy Blue-flag. "Escaped to a small bank in a vacant lot." Hillsboro, Highland Co. Katie M. Roads.

571. *Gymnadeniopsis clavellata* (Mx.) Rydb. Green Wood-orchis. Wayne Twp., Ashtabula Co. "Also in Trumbull and Geauga Cos." Lawrence E. Hicks.

572. *Limnorchis hyperborea* (L.) Rydb. Tall Bog-orchis. "In a sphagnum bog," Richland Twp., Huron Co. Charles F. Walker.

573. *Lysias orbiculata* (Pursh) Rydb. Large Roundleaf Orchis. "In woods, north bank of Clear Fork Gorge." Ashland Co. Charles F. Walker.

575. *Blephariglottis ciliaris* (L.) Rydb. Yellow Fringed-orchis. "Seventy plants along roadside on one side of road within 100 yards." Swanton Twp., Lucas Co. E. L. Moseley.

577. *Blephariglottis lacera* (Mx.) Farw. Ragged Fringed-orchis. Wayne Twp., Ashtabula Co. Northern Trumbull Co. Lawrence E. Hicks.

583. *Triphora trianthophora* (Sw.) Rydb. Nodding Triphora. "Rare in damp, dense woods." Williamsfield Twp., Ashtabula Co. "Also seen in southern Wayne Twp." Lawrence E. Hicks.

586. *Ibidium strictum* (Rydb.) House. Hooded Lady's-tresses. Northern Trumbull Co. Burton, Geauga Co. Lawrence E. Hicks.

588. *Ibidium cernuum* (L.) House. Nodding Lady's-tresses. Dean Forest, Lawrence Co. Charles F. Walker.

594. *Malaxis unifolia* Mx. Green Addermouth. Ten miles northwest of Ironton, Lawrence Co. H. C. Sampson.

602. *Corallorrhiza odontorhiza* (Willd.) Nutt. Small-flowered Coral root. "On tops of ridges." Laurelville, Hocking Co. W. H. Camp.

627. *Coptis trifolia* (L.) Salisb. Gold-thread. "Damp woods." Near Wayne, Ashtabula Co. Also North Trumbull Co. Lawrence E. Hicks. Kingsville, Ashtabula Co. Geo. Sleesman.

657.1. *Berberis thunbergii* DC. Japanese Barberry. "Escaped in three localities; some bushes 3 ft. high." Wayne Twp., Ashtabula Co. Lawrence E. Hicks.

700. *Lepidium draba* L. Hoary Peppergrass. "Along the road near Athens," Athens Co. P. S. Wamsley.

706. *Sophia pinnata* (Walt.) Howell. Pinnate Tansy-mustard. Hillsboro, Highland Co. Katie M. Roads.

707. *Sophia incisa* (Engelm.) Green. Western Tanzy-mustard. "In a freight-yard." Hillsboro, Highland Co. Katie M. Roads.

708. *Cheirinia cheiranthoides* (L.) Link. Worm-seed Mustard. "Wet woods near edge of Scioto Marsh." McGuffey, Hardin Co. R. A. Dobbins. "In the freight yards," Hillsboro, Highland Co. Katie M. Roads.

718. *Barbarea stricta* Andrz. Erect Winter-cress. "On river bank." Wapakoneta, Auglaize Co. Wm. Kayser.

715. *Hesperis matronalis* L. Dame's Rocket. Wayne Twp., Ashtabula Co. Lawrence E. Hicks.

755. *Cleome spinosa* L. Spider-flower. Andover, Ashtabula Co. Lawrence E. Hicks.

761. *Geranium molle* L. Dove's-foot Crane's-bill. "In a lawn." Wapakoneta, Auglaize Co. Wm. Kayser.

762. *Geranium pusillum* L. Small-flowered Crane's-bill. Bowling Green, Wood Co. E. L. Moseley.

776. *Linum medium* (Planch.) Britt. Stiff Flax. Higby Prairie, Ross Co. Floyd Bartley and E. S. Thomas.

783. *Polygala cruciata* L. Crossleaf Milkwort. North of Glengary, Lucas Co. E. L. Moseley.

788. *Polygala polygama* Walt. Racemed Milkwort. With white flowers. Near Wabash R. R., South of Swanton, Fulton Co. Mrs. Ralph Engle.

817. *Malva sylvestris* L. High Mallow. "In a vacant lot." Hillsboro, Highland Co. Katie M. Roads. Wapakoneta, Auglaize Co. W. M. Kayser.

827. *Napaea dioica* L. Glade-mallow. Jackson road at Scioto R., Ross Co. Floyd Bartley and E. S. Thomas.

840. *Hypericum cistifolium* Lam. Round-podded St. John's-wort. Dunn's prairie, Madison Co. Edward S. Thomas.

849. *Sarothra gentianoides* L. Orange-grass. Bogart, Erie Co. Geo. Sleesman.

850. *Triadenum virginicum* (L.) Raf. Marsh St. John's-wort. Three miles east of Kingston, Ross Co. Floyd Bartley and Edward S. Thomas.

852. *Crocanthemum majus* (L.) Britt. Hoary Frostweed. North of Whitehouse, Lucas Co. E. L. Moseley.

854. *Lechia minor* L. Thyme-leaf Pinweed. Spencer Twp., Lucas Co. E. L. Moseley.

873. *Viola pallens* (Banks) Brain. Woodland White Violet. In bog near Celeryville, Huron Co. Hiram Thut and R. B. Gordon.

875.1. *Viola cucullata* Art. Marsh Blue Violet. Three miles east of Kingston, Ross Co. Floyd Bartley and E. S. Thomas.

884. *Viola sagittata* Ait. Arrowleaf Violet. Prairie near Higby, Ross Co. Floyd Bartley and E. S. Thomas. Wayne Twp., Ashtabula Co. Lawrence E. Hicks. Beverly, Washington Co. Mrs. Elizabeth T. Owen.

898. *Alsine graminea* (L.) Britt. Lesser Stitchwort. "Along a steep bank." Hillsboro, Highland Co. Katie M. Roads.

912. *Silene latifolia* (Mill.) Britt & Rend. Bladder Campion. "In old field above Clear Fort Gorge," Ashland Co. Charles F. Walker and Lawrence E. Hicks.

916. *Silene noctiflora* L. Night-blooming Catchfly. "Fairly common weed in fields." Wayne Twp., Ashtabula Co. Lawrence E. Hicks.

925. *Dianthus armeria* L. Deptford Pink. Williamsfield Twp., Ashtabula Co. Also near Pymatuning R., North Trumbull Co. Lawrence E. Hicks.

927. *Dianthus barbatus* L. Sweet-William. "Occasional escape." Wayne Twp., Ashtabula Co. Lawrence E. Hicks.

933. *Allionia nyctaginea* Mx. Heartleaf Umbrella-wort. Buchtel, Athens Co. Len. Stephenson.

951. *Chenopodium glaucum* L. Oakleaf Goosefoot. Hillsboro, Highland Co. Katie M. Roads.

955. *Chenopodium boscianum* Moq. Bosc's Goosefoot. Barnesville, Belmont Co. Emma E. Laughlin. Hillsboro, Highland Co. Katie M. Roads.

1009. *Potentilla recta* L. Upright Cinquefoil. Western Preble Co. Katie M. Roads.

1022.1. *Rubus laciniatus* Willd. Cutleaf Blackberry. In waste ground, Clinton Twp., Franklin Co. John H. Schaffner. Also South Bass Island, Ottawa Co. "Escaped and established in several places." M. E. Stickney.

1034. *Filipendula rubra* (Hill.) Rob. Queen-of-the-prairie. Colebrook, Ashtabula Co. J. S. Hine and C. F. Walker.

1037. *Spiraea tomentosa* L. Steeple-bush. Higby Prairie, Ross Co. Floyd Bartley and E. S. Thomas.

1039. *Dalibarda repens* L. Dalibarda, near Chardon, Geauga Co. Lawrence E. Hicks.

1053. *Sorbus scopulina* Greene. Western Mountain-ash. Northern Trumbull Co. Barton, Geauga Co. Lawrence E. Hicks.

1086. *Prunus mahaleb* L. Mahaleb Cherry. Near Hillsboro, Highland Co. John D. Roads.

1104. *Baptisia leucantha* T. & G. Large White Wild-indigo. Dunn's prairie, Madison Co. Edward S. Thomas.

1126. *Psoralea onobrychis* Nutt. Sainfoin Psoralea. West of Adelphi, Ross Co. Floyd Bartley and Edward S. Thomas. Buchtel, Athens Co. Len. Stephenson.

1148. *Meibomia rigida* (Ell.) Ktz. Rigid Tick-trefoil. North-west of Monclova, Lucas Co. E. L. Moseley.

1150. *Meibomia obtusa* (Muhl.) Vail. Ciliate Tick-trefoil. Hocking Co. E. S. Thomas and E. L. Moseley.

1153. *Lespedeza nuttallii* Darl. Nuttall's Bush-clover. Fairfield Co. E. S. Thomas and E. L. Moseley.

1154. *Lespedeza violacea* (L.) Pers. Violet Bush-clover. Stanhope Gorge, Williamsfield Twp., Ashtabula Co. Lawrence E. Hicks.

1157. *Lespedeza virginica* (L.) Britt. Slender Bush-clover. Hocking Co. E. L. Moseley, A. R. Harper and E. S. Thomas.

1160. *Lespedeza capitata* Mx. Round-headed Bush-clover. Higby Prairie, Ross Co. Floyd Bartley and E. S. Thomas.

1160.1. *Lespedeza striata* (Thunb.) H. & A. Japan Clover. Jackson Road at Scioto River, Ross Co. Floyd Bartley and E. S. Thomas.

1172. *Lathyrus ochroleucus* Hook. Cream-colored Pea. "In tamarack bog near Portage Lakes," Summit Co. Charles F. Walker.

1182. *Sedum telephioides* Mx. American Orpine. Escaped near Andover, Ashtabula Co. Lawrence E. Hicks.

1195. *Rotala ramosior* (L.) Koehne. Rotala. "In shallow ditch east of Cook School, west of Toledo," Lucas Co. E. L. Moseley.

1200. *Rhexia virginica* L. Virginia Meadow-beauty. Higby Prairie, Ross Co. Floyd Bartley and E. S. Thomas. Bogart, Erie Co. Geo. Sleesman.

1205. *Rhamnus alnifolia* L'Her. Alderleaf Buckthorn. "Tamarack bog near Portage Lakes," Summit Co. Charles F. Walker.

1241. *Cotinus cotinus* (L.) Sarg. European Smoke-tree. "A common escape." Near Wick, Wayne Twp., Ashtabula Co. Also Northern Trumbull Co. Lawrence E. Hicks.

1253. *Humulus japonicus* S. & Z. Japanese Hop. "Escaped near Andover," Ashtabula Co. Lawrence E. Hicks.

1281. *Betula lenta* L. Sweet Birch. Wayne Twp., Ashtabula Co. Burton, Geauga Co. Lawrence E. Hicks.

1298. *Populus heterophylla* L. Swamp Poplar. Williamsfield Twp., Ashtabula Co., Northern Trumbull Co. Lawrence E. Hicks.

1322. *Salix pedicellaris* Pursh. Bog Willow. New Haven Bog, Richmond Twp., Huron Co. Robert B. Gordon.

1324.1. *Philadelphus inodorus* L. Scentless Mock-orange. "In a pasture lot along the railroad tracks." Liberty Twp., Highland Co. Probably escaped from cultivation. Katie M. Roads.

1338. *Epilobium lineare* Muhl. Linear-leaf Willow-herb. "Prairie." Spencer Twp., Lucas Co. E. L. Moseley.

1362. *Cucumis melo* L. Muskmelon. "In a neglected pasture lot." Hillsboro, Highland Co. Katie M. Roads.

1379. *Trientalis americana* (Pers.) Pursh. Star-flower. "Dry woods." North Trumbull Co. Lawrence E. Hicks. Kingsville, Ashtabula Co. Geo. Sleesman.

1388. *Chimaphila umbellata* (L.) Nutt. Pipsissewa. Sugar Grove, Fairfield Co. B. S. Meyer.

1392. *Hypopitys lanuginosa* (Mx.) Nutt. Hairy Pinesap. Rock Hill, Ross Co. Floyd Bartley. "On south and west facing slopes." Laurelville, Hocking Co. W. H. Camp.

1402. *Epigaea repens* L. Trailing Arbutus. Wayne Twp., Ashtabula Co. Lawrence E. Hicks.

1424.1. *Navarretia intertexta* (Benth.) Hook. Navarretia. Blue-flowered variety. "Several small patches in a large pasture, growing for a number of years." Introduced from the west. Lafayette, Allen Co. Alfred Hedges and R. A. Dobbins.

1428. *Ipomoea lacunosa* L. Small-flowered White Morning-glory. Hillsboro, Highland Co. Also in Liberty Twp., Highland Co. Katie M. Roads.

1432. *Convolvulus spithamaeus* L. Upright Bindweed. East of Gahanna, Franklin Co. John H. Schaffner.

1441. *Cuscuta cephalanthi* Engelm. Buttonbush Dodder. Glengary, Lucas Co. E. L. Moseley.

1466. *Gentiana puberula* Mx. Downy Gentian. Cook School, "Oak openings," west of Toledo, Lucas Co. E. L. Moseley.

1467. *Gentiana saponaria* L. Soapwort Gentian. Prairie near Higby, Ross Co. Floyd Bartley and E. S. Thomas.

1472. *Obolaria virginica* L. Pennywort. Beverly, Washington Co. Mrs. Elizabeth T. Owen.

1473. *Bartonia virginica* (L.) B. S. P. Yellow Bartonia. "Rare plant along Pymatuning R. in short grass pasture." Wayne Twp., Ashtabula Co. Lawrence E. Hicks.

1481. *Acerates floridana* (Lam.) Hitchc. Florida Milkweed. One mile north of Carpenter, Meigs Co. H. C. Sampson.

1494. *Gonolobus laevis* Mx. Sandvine. "In a thicket along railroad embankment on west bank of Scioto River, south of Greenlawn Ave., Columbus, Franklin Co. Robert B. Gordon.

1515. *Solanum rostratum* Dun. Buffalo-bur. Hillsboro, Highland Co. Katie M. Roads.

1521.1. *Chelone obliqua* L. Red Turtle-head. Near Black Fork, Washington Twp., Lawrence Co. Charles F. Walker. Also Hocking Co. E. S. Thomas and E. L. Moseley. In a swamp, Wapakoneta, Auglaize Co. W. M. Kayser.

1553. *Aureolaria virginica* (L.) Penn. (Dasystoma flava (L.) Wood). Downy False Floxglove. Wayne Twp., Ashtabula Co. Lawrence E. Hicks.

1554. *Aureolaria laevigata* (Raf.) Raf. Entire-leaf False Foxglove. Rock Hill, Ross Co. Floyd Bartley.

1561. *Castilleja coccinea* (L.) Spreng. Scarlet Painted-cup. Green Brier District, Jefferson Twp., Adams Co. R. B. Gordon, Conrad Roth and E. Lucy Braun.

1568. *Chaenorrhinum minus* (L.) Lange. Lesser Toadflax. Wapakoneta, Auglaize Co. Along railroad track. Wm. Kayser. Ada, Hardin Co. R. A. Dobbins.

1607. *Echium vulgare* L. Blueweed. "In the freight yard." Hillsboro, Highland Co. Katie M. Roads.

1616. *Trichostema dichotomum* L. Blue-curls. Clear Creek, Hocking Co. A. R. Harper and E. L. Moseley.

1627. *Scutellaria integrifolia* L. Hyssop Skullcap. Higby Prairie, Ross Co. Floyd Bartley and E. S. Thomas.

1646. *Cunila origanoides* (L.) Britt. American Dittany. Perry Co. E. A. Albaugh.

1666.1. *Dracocephalum speciosum* Sw. Showy Dragonhead. Along the Scioto river, five miles southwest of Marion, Marion Co. Native of the Mississippi valley. Differs from *D. virginianum* L. by having the upper leaves not conspicuously reduced; by its having a very robust stem and thick, somewhat fleshy leaves; and by its acute, triangular calyx-teeth. E. N. Transeau and H. C. Sampson.

1668.1. *Galeopsis ladanum* L. Red Hemp-nettle. Broad-leaved variety. "A very large patch along the railroad track." Hillsboro, Highland Co. Katie M. Roads.

1672. *Lamium purpureum* L. Red Henbit. Hillsboro, Highland Co. Katie M. Roads.

1687. *Salvia lanceifolia* Poir. Lanceleaf Sage. "Edge of field of soybeans." Wapakoneta, Auglaize Co. W. M. Kayser.

1691. *Plantago cordata* Lam. Heartleaf Plantain. "Edge of swamp east of Indian Lake." Richland Twp., Logan Co. James S. Hine.

1695.1. *Plantago purshii* R. & S. Pursh's Plantain. "Plentiful in a pasture near Wabash R. R. south of Swanton," Fulton Co. Sent in along with *P. aristata*. Mrs. Ralph Engle and E. L. Moseley.

1739. *Carum carui* L. Caraway. Wapakoneta, Auglaize Co. "Along road." Wm. Kayser.

1744. *Cornus stolonifera* Mx. Red-osier Dogwood. Three miles east of Kingston, Ross Co. Floyd Bartley and E. S. Thomas.

1777. *Viburnum dentatum* L. Toothed Arrow-wood. Remove distribution record, Martinsville, Clinton Co. (1926) from the list. The plant is evidently *V. scabrellum*.

1778. *Viburnum scabrellum* (T. & G.) Chapm. Roughleaf Arrow-wood. "A few shrubs on Rabbit Island," Buckeye Lake, Perry Co. Charles F. Walker. Also in prairie near Higby, Ross Co. E. S. Thomas.

1784. *Viburnum opulus americanum* (Mill.) Art. Cranberry-tree. "Open swampy places, fairly common." Williamsfield Twp., Ashtabula Co. Lawrence E. Hicks.

1785. *Viburnum alnifolium* Marsh. Hobblebush. Along Pymatuning R., Northern Trumbull Co. Lawrence E. Hicks.

1802. *Diervilla diervilla* (L.) MacM. Bush-honeysuckle. Clear Fork Gorge, Southern Ashland Co. Conneaut R., Ashtabula Co. Lawrence E. Hicks.

1817. *Lobelia puberula* Mx. Downy Lobelia. "Roadside," Washington Twp., Lawrence Co. Charles F. Walker. Also prairie near Higby, Ross Co. Floyd Bartley and E. S. Thomas.

1844. *Helianthus grosse-serratus* Mart. Sawtooth Sunflower. Lafayette, Allen Co. Alfred Hedges.

1856. *Helianthus petiolaris* Nutt. Prairie Sunflower. "In the freight yard," Hillsboro, Highland Co. Katie M. Roads.

1861. *Coreopsis major* Walt. Greater Tickseed. Ten miles west of Ironton, Lawrence Co. H. C. Sampson.

1864. *Bidens laevis* (L.) B. S. P. Smooth Bur-marigold. Buchtel, Athens Co. Len. Stephenson.

1867. *Bidens comosa* (Gr.) Wieg. Leafy-bracted Bur-marigold. Little Darby Creek, near Irwin, Union Co. E. N. Transeau and E. S. Thomas.

1874.1. *Cosmos bipinnatus* Cav. Cosmos. "Escaped in several places near Wick," Wayne Twp., Ashtabula Co. Lawrence E. Hicks.

1886. *Helenium nudiflorum* Nutt. Purple-headed Sneezeweed. Hocking Co. Arthur R. Harper, E. S. Thomas and E. L. Moseley.

1895. *Anaphalis margaritacea* (L.) Benth. & Hook. Pearly Everlasting. Northern Trumbull Co. Near Burton, Geauga Co. Wayne Twp., Ashtabula Co. Lawrence E. Hicks.

1901. *Grindelia squarrosa* (Pursh) Dun. Broadleaf Gum-plant. Lafayette, Allen Co. Alfred Hedges.

1908. *Solidago hispida* Muhl. Hairy Goldenrod. Northeast of Cook School, "Oak openings," west of Toledo, Lucas Co. E. L. Moseley.

1928. *Boltonia asteroides* (L.) L'Her. Boltonia. Ada, Hardin Co. R. A. Dobbins.

1938. *Aster drummondii* Lindl. Drummond's Aster. Madison Co. "Also at Boulder Dam, Scioto R.," Delaware Co. Edward S. Thomas.

1940. *Aster undulatus* L. Wavy-leaf Aster. Hocking Co. Also in Red Hills, Franklin Co., Rock Hill, Ross Co., and Fairfield Co. "Abundant on dry, sunny hillsides." E. S. Thomas and E. L. Moseley.

1941. *Aster patens* Ait. Late Purple Aster. Perry Co. E. A. Albaugh.

1942. *Aster phlogifolius* Muhl. Haines, Hocking Co. Floyd Bartley and E. S. Thomas.

1951. *Aster vimineus* Lam. Small White Aster. Liberty Twp., Highland Co. Katie M. Roads.

1954. *Aster salicifolius* Lam. Willow Aster. Holland, Lucas Co. E. L. Moseley.

1966. *Doellingeria umbellata* (Mill.) Nees. Tall White-top Aster. Cedar Swamp, Champaign Co. John H. Schaffner, Robert B. Gordon and W. H. Camp.

1971. *Eupatorium altissimum* L. Tall Thoroughwort. Kibler's prairie, Pickaway Co. Floyd Bartley and Edward S. Thomas.

1973. *Eupatorium rotundifolium* L. Roundleaf Thoroughwort. "Neotoma," Hocking Co. E. L. Moseley.

1976. *Eupatorium aromaticum* L. Smaller White Snake-root. Revenge, Fairfield Co. E. S. Thomas and E. L. Moseley.

1982. *Lacinaria scariosa* (L.) Hill. Large Blazing-star. Perry Co. E. A. Albaugh.

1991. *Anthemis arvensis* L. Field Dog-fennel. Wapakoneta, Auglaize Co. "Along railroad track." Wm. Kayser.

2011. *Synosma suaveolens* (L.) Raf. Sweet-scented Indian-plantain. Canal Winchester, Franklin Co. E. S. Thomas.

2015. *Senecio vulgaris* L. Common Groundsel. "Common in the waste places of the Ernst's Nursery Gardens." Eaton, Preble Co. Katie M. Roads.

2026a. *Cirsium arvense integrifolium* Wimm & Grab. Bellefontaine, Logan Co. Myron Headington and E. L. Moseley.

2026.1. *Mariana mariana* (L.) Hill. Mary's Thistle. "Accidental in a garden." Bowling Green, Wood Co. E. L. Moseley.

2029.2. *Centaurea nigra* L. Black Star-thistle. Salt Creek Twp., Pickaway Co. Floyd Bartley.

2030.1. *Centaurea solstitialis* L. Barnaby's Star-thistle. Webster Twp., Wood Co. E. L. Moseley.

2056. *Hieracium paniculatum* L. Panicled Hawkweed. Hocking Co. E. L. Moseley, A. R. Harper and E. S. Thomas. Also Rock Hill, Ross Co. Floyd Bartley.

2063. *Hieracium aurantiacum* L. Orange Hawkweed. Madison, Lake Co. Geo. Sleesman.

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